



1,1,1-TRICHLOROETHANE

GENERAL

1,1,1-Trichloroethane (1,1,1-TE) is commonly called methyl chloroform. Other synonyms are methyltrichloromethane, chloroethene, or 1,1,1-TCE. 1,1,1-Trichloroethane is a colorless, nonflammable liquid with an odor similar to chloroform. Its solubility in water is 4,400 milligrams per liter (mg/l) at 20°C. It is widely used as a degreaser and cleaner for metals, a spot remover, and a propellant.

1,1,1-TE released to the air degrades slowly with an estimated half-life of 1 to 8 years. It slowly hydrolyzes in water with an estimated half-life of greater than 6 months.

HEALTH EFFECTS

Humans

The primary toxic effects in humans subjected to short-term, very high-level inhalation exposure to 1,1,1-TE are manifestations of depression of the central nervous system. Symptoms include dizziness, incoordination, drowsiness, increased reaction time, unconsciousness, and death. A number of human fatalities related to accidental exposure in closed spaces have been reported, some of which may have been "sudden death" due to sensitization of the heart to epinephrine. Abuse (sniffing) has also resulted in human fatalities. In an epidemiological study of workers occupationally exposed to 1,1,1-TE for 6 years, there were no clinically pertinent findings associated with the exposure. Inhalation exposure to 1,1,1-TE from approximately 6,000 to 20,000 parts per million (ppm) has been found to be lethal in humans.

A 47-year old man mistakenly consumed one ounce of 1,1,1-TE, or approximately 0.6 grams per kilogram (g/kg) of body weight. He became nauseated within 30 minutes and developed progressively severe vomiting and diarrhea over the next few hours. Urinalysis and clinical chemistry tests revealed evidence of only minimal hepato-renal injury. After resolution of the vomiting and diarrhea, the patient was asymptomatic during a 2-week observation period.

Repeated skin contact with liquid 1,1,1-TE may produce a dry, scaly, and fissured dermatitis. Liquid and vapor are irritating to eyes upon contact and may produce mild conjunctivitis but recovery is usually rapid.

Animal Studies

The acute oral LD₅₀ values for several species in g/kg body weight are: male rats 12.3; female rats, 10.3; female mice, 11.24; female rabbits, 5.66; and male guinea pigs, 9.47. Deaths were due primarily to anesthesia. Recovery was rapid and complete in surviving animals. The material caused only minor, transient irritation in the eyes of rabbits. Rats survived inhalation exposure to 8,000 ppm or 43,450 milligrams per cubic meter (mg/m³) vapors in air for 5 hours without any detectable injurious effects.

Mice exposed to vapors of 1,1,1-TE at 1,000 ppm continuously for 14 weeks had significant changes in the centrilobular hepatocytes, significant increase in liver weight, and triglyceride accumulation in the liver. No such effects were observed at 250 ppm exposure.

Rats administered 1,1,1-TE orally at 2.5 and 5.0 g/kg body weight for 12 weeks exhibited reduced body weight gain and central nervous system effects. In another study, rats and mice were given oral doses of 1,500 mg/kg and 5,600 mg/kg, respectively, for 78 weeks. Reduced body weight gain and decreased survival time were manifest in both rats and mice. The incidence of histopathological change was no greater for treated animals than for control animals.

TERATOGENICITY AND REPRODUCTIVE EFFECTS

Studies in experimental animals indicate that 1,1,1-TE has not been shown to cause fetotoxicity, teratogenicity, or adverse effects on reproduction. There is no evidence to indicate that 1,1,1-TE produces any teratogenic or reproductive effects in humans.

MUTAGENICITY

1,1,1-TE has been reported to be mutagenic in the Ames Salmonella typhimurium assay. It has been shown to be negative in a dominant lethal assay at daily doses as high as 8,500 mg/kg.

CARCINOGENICITY

To date, there is no definitive evidence to indicate that 1,1,1-TE causes cancer in experimental animals or in humans.

STANDARDS AND GUIDELINES

The Occupational Safety and Health Administration Standard for 1,1,1-TE in the workplace is 350 ppm (1900 mg/m³), based on an eight-hour time-weighted average. Under the Safe Drinking Water Act, the U.S. Environmental Protection Agency has established a maximum contaminant level (MCL) for 1,1,1-TE in drinking water at 200 micrograms/liter (µg/l).

PREPARED BY: KHIZAR WASTI, Ph.D.
TOXICOLOGIST
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